

REMARKS

Claims 1 to 14 are all the claims pending in the application, prior to the present Amendment.

The Examiner makes of record a telephone restriction requirement, and applicants election of Group 2, claims 2 to 8 for prosecution in the present application. The Examiner requires applicants to confirm this election. Applicants hereby confirm this election.

The Examiner has objected to claims 2 to 8 because they depend from claim 1, which is not included in the elected group. In response, applicants have amended claim 2 to include the recitations of claim 1, and have canceled claim 1. Applicants have added new claims 15 to 17 that depend from claim 2.

Claims 2-4, 6 and 8 have been rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,888,258 to Kaaber in view of U.S. Patent No. 6,139,990 to Kubota et al.

Applicants submit that Kaaber and Kubota et al do not disclose or render obvious the presently claimed invention and, accordingly, request withdrawal of this rejection.

The present invention, as set forth in claim 2 as amended above, is directed to a method for producing roundish fused alumina particles, wherein the roundish fused alumina particles have a mean particle size of 5 to 4,000 μm and a roundness of 0.85 or more, wherein the method comprises removing edges of fused alumina particles by making the fused alumina particles

collide with each other. The roundish fused alumina particles of the present invention exhibit a large thermal conductivity.

In the Office Action, the Examiner has asserted that Kaaber discloses in Example 2 using a jet mill to reduce the size of alumina particles to a size of no more than 100 μ m, but does not disclose using the jet mill to round the particles.

The Examiner has relied on Kubota et al as disclosing a method of modifying graphite particles, by using a jet mill to collide particles to reduce particle size to 1 to 100 μ m and to round the particles to a roundness of not less than 0.86.

The Examiner argues that it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the reducing and rounding steps disclosed by Kubota et al with the steps of milling alumina disclosed by Kaaber.

In response, applicants point out that Kaaber relates to a grinding aid for use in an abrasive material, wherein the grinding aid consists of fluoride-containing inorganic compounds such as cryolite (Na_3AlF_6), which is obtained from a “cold bath.”

Kaaber describes a “cold bath” at column 3, lines 26 to 32 as follows:

As will be known, metallic aluminum is manufactured on a large industrial scale by reduction in electrolysis cells of Al_2O_3 , which has been dissolved in a melt produced by fusing cryolite together with minor amounts of calcium fluoride and other fluorides. Additional aluminum fluoride is added to adjust the chemical composition of the melt bath, and 5-10% by weight of aluminum oxide, which is the starting material proper in the aluminum manufacture, is continuously dissolved in the melt.

Such electrolysis baths occur as waste in the closedown of the electrolysis cells, e.g. because of repairs or because of the build-up of impurities in the bath after an extended period of use. The solidified electrolysis bath mass is usually called "cold bath", and it constitutes a recycling problem because the mass balance of the aluminum works means that the bath amount increases in the course of time.

Kaaber further describes a "cold bath" at column 3, lines 33 to 42 as follows:

The cold bath contains an acid mixture of various aluminum fluorides, other metal fluorides, minor amounts of metallic aluminum, optionally coal from the lining of the electrolysis cell and ceramic insulation material. An important feature of the cold bath is that it contains considerable amounts of chiolite, which has the formula $5 \text{ NaF} \cdot 3 \text{ AlF}_3$, i.e. a compound having an NaF/AlF_3 molar ratio of $5/3$, together with cryolite. For example, the cold bath may typically contain 40-44% by weight of cryolite and 40-44% by weight of chiolite.

In Kaaber, as disclosed in the Abstract, the grinding aid is produced by a method wherein the cold bath is crushed, optionally in several steps, whereby particles of an optional free metallic aluminium residue are rolled to flakes, following which the crushed material is screened to optionally sort out the formed aluminium flakes, and then the residual material is recovered as a product or is optionally subjected to further grinding and optionally screening to provide a material which preferably has a grain size distribution corresponding to 100% by weight less than 100 micrometers. This grinding aid lends itself for use in the product of abrasive materials.

Kaaber discloses in Examples 1 and 2 specific methods for producing a grinding aid from a cold bath. In Example 1, Kaaber grinds a "cold bath" containing a major amount of cryolite and chiolite and a small amount (2.3%) of alumina in order to reduce the particle size of cryolite, etc., and does not disclose making fused alumina particles roundish. Further, Kaaber does not

refer to the roundness or thermal conductivity of an alumina particle. In Example 2 of Kaaber, the crushed and screened cold bath was ground with use of a jet mill in a second grinding step.

In other words, Kaaber neither teaches nor suggests grinding fused alumina particles with use of a jet mill.

Therefore, the combination of Kaaber and Kubota et al neither teaches nor suggests the method of the present invention for producing roundish “fused alumina particles”.

The method of the present invention produces roundish “fused alumina particles” by removing edges of fused alumina particles by making the fused alumina particles collide with each other.

Fused alumina particles, which are used as a raw material in the method of the present invention for producing roundish fused alumina particles, are virtually single crystal particles, as disclosed at page 2, lines 25 to 27, and page 7, lines 9 and 10 of the present specification, and are generally produced by the method comprising the following steps:

- (a) fusing a calcined alumina in an electric furnace at about 2500 to 3000°C;
- (b) pouring the fused alumina into a vessel and cooling it therein to obtain an alumina ingot; and
- (c) crushing the alumina ingot, e.g., by a jaw crusher, a roll breaker, and the like to form fused alumina particles.

Since fused alumina particles, which are used as a raw material in the method of the present invention for producing roundish fused alumina particles, are virtually formed of single crystal, when the fused alumina particles are collided with each other, e.g. by a jet mill, so-called “pulverization” of fused alumina particles hardly occurs, and rather the characteristic edges of the fused alumina particles are broken. See page 7, lines 9 to 21 of the present specification. Accordingly, the number of sharp edges of the fused alumina particles is reduced, and roundish fused alumina particles having no sharp edges are finally obtained.

The above effects of the method of the present invention are not suggested or taught by Kaaber and Kubota et al.

Since the roundish fused alumina particles obtained by the method of the present invention are virtually single crystal particles, rather than polycrystalline particles, they exhibit a large thermal conductivity. See page 2, lines 25 to 27 of the present specification.

Incidentally, when spherical alumina particles are made by a thermal spray process such as one described in U.S. Patent 6,261,484 B1, which was cited in the “Election/Restrictions” section of the present Office Action, molten alumina particles are very rapidly cooled and solidified, and thereby become polycrystalline particles containing alpha-alumina, beta-alumina, and gamma-alumina. See page 2, lines 22 to 25 of the present specification. Further, alumina particles made by sintering alumina primary particles, such as alumina particles made by a sol-gel process, are also polycrystalline particles.

Regarding this, Figs. A and B attached hereto show X-ray diffraction analysis of roundish fused alumina particles of Example 5 of the present application (Fig. A), and X-ray diffraction analysis of spherical alumina particles obtained by the thermal spray process (Fig. B), respectively.

In view of the above, applicants submit Kaaber and Kubota et al do not disclose or render obvious the presently claimed invention and, accordingly, request withdrawal of this rejection.

Claim 5 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Kaaber in view of Kubota as applied to claim 3 above, and further in view of U.S. Patent No. 3,837,583 to Kugelberg et al.

In addition, claim 7 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Kaaber in view of Kubota as applied to claim 4 above, and further in view of U.S. Patent No. 5,421,524 to Haddow.

Claims 5 and 7 are dependent claims that depend from claim 2. Applicants submit that these claims are patentable for the same reasons as discussed above in connection with claim 2. Kugelberg et al and Haddow do not supply the above discussed deficiencies. Accordingly, applicants request withdrawal of these rejections.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the

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Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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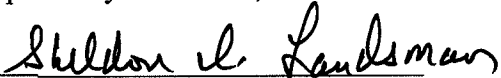
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